

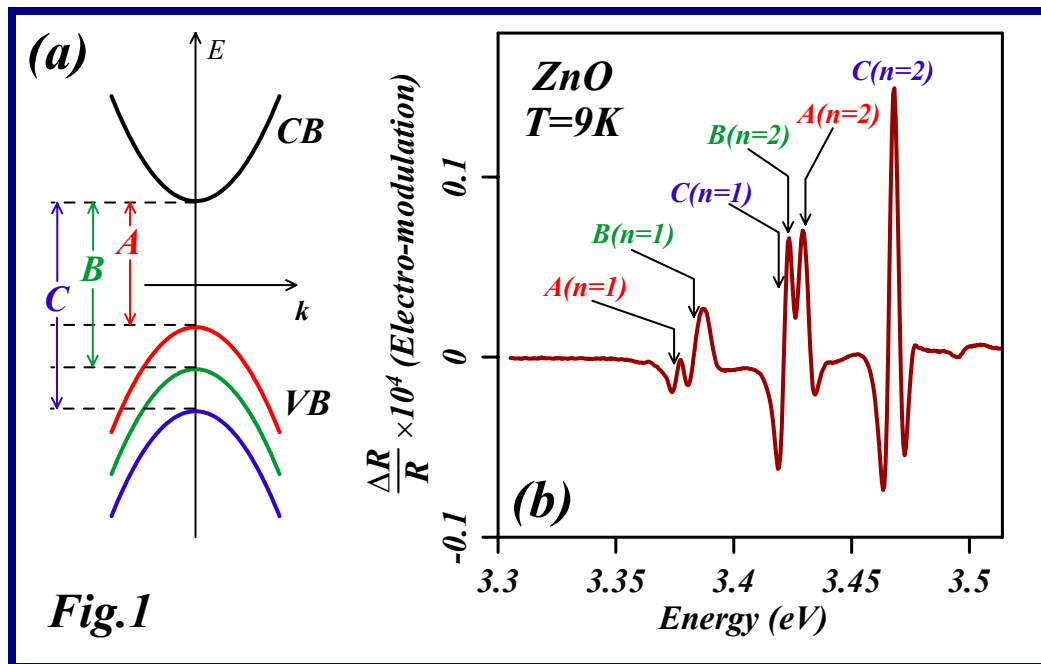
# “Zinc Oxide”, a Newly Rediscovered Wide Band Gap II-VI Semiconductor

Anant K. Ramdas and Sergio Rodriguez, Purdue University, DMR-0102699

**Research goal:** *To explore, discover, and delineate novel electronic, vibrational, and magnetic excitations in ZnO, a wide band gap II-VI semiconductor with wurtzite structure, and its magnetic ternary alloys. As a part of the program, to discover through spectroscopy, the isotopic mass dependence of the direct band gap of these ternaries.*

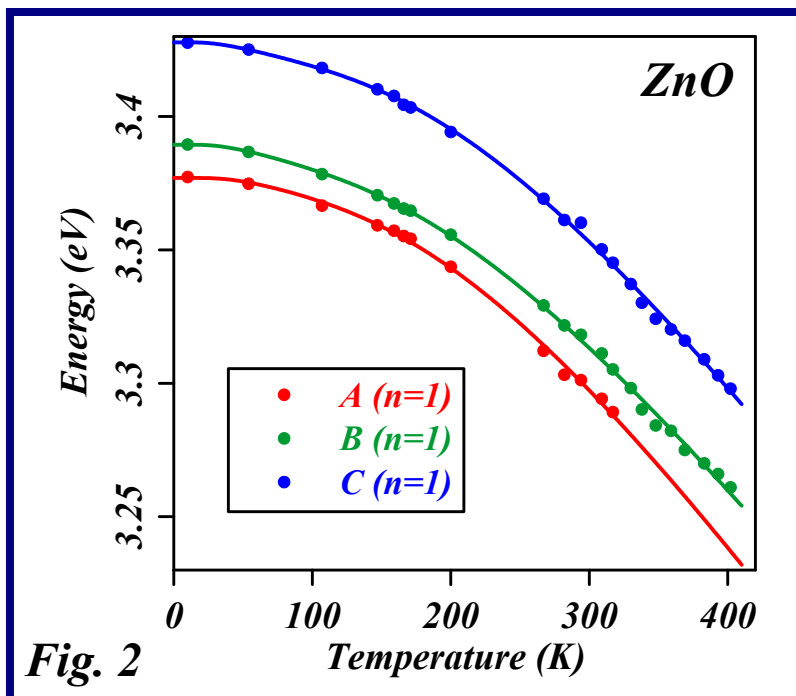
*The sharp signatures in Fig. 1 originate in the energies required to lift electrons from the three valence bands (VB) into the conduction band (CB) and allow the energy separations  $A$ ,  $B$ , and  $C$ , i.e. band gaps, to be deduced. These values being large, ZnO offers a potential for opto-electronic applications in the violet to the blue, as an alternative to the currently preferred GaN.*

*Temperature dependence of the band gaps, shown in Fig. 2, allows the band gaps  $E_A$ ,  $E_B$ , and  $E_C$  to be deduced for a hypothetical static ZnO crystal, i.e. free from lattice vibrations.*



# “Zinc Oxide”, a Newly Rediscovered Wide Band Gap II-VI Semiconductor

Anant K. Ramdas and Sergio Rodriguez, Purdue University, DMR-0102699



**Future Plans:** In the near future this fundamental effect will be studied as a function of isotopic composition. It is anticipated that it will provide valuable insights into the interaction of lattice vibrations and electrons in a crystal.

**Education/Broader Impact:** This continuing collaboration between M. Cardona (Max-Planck Institute), H. Alawadhi (UAE), and the Purdue group is typical in our program. Extended and ongoing collaborations with E. E. Haller (UCB), J. K. Furdyna (Notre Dame), T. R. Anthony (GE), L. R. Ram-Mohan (WPI), Z. Barticevic (Chile), Hyunjung Kim (S. Korea), H. Alawadhi (UAE), and M. J. Seong (S. Korea); interactions with graduate students (S. Tsoi, X. Lu, and G. Chen), as well as I. Miotkowski, the senior scientist in charge of crystal growth; and the enthusiastic participation of enterprising undergraduates (C. Scheper, J. Germano, and S. Brownfield) in the NSF sponsored REU programs have created a stimulating research ambience. The entire research experience presages for the students exciting future professional careers in universities, national and industrial laboratories.